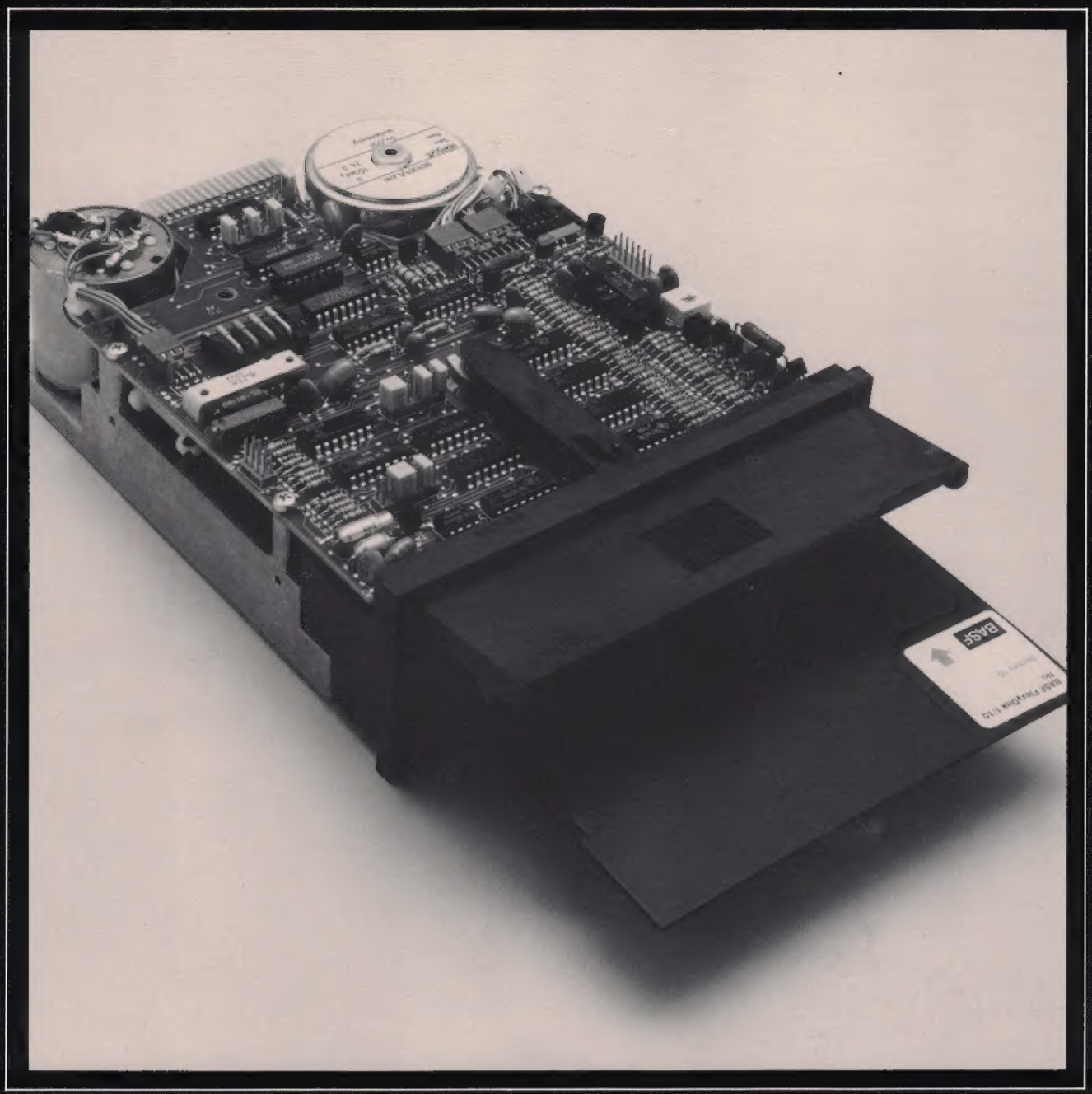
OEM Peripheral Storage Products

BASF

BASF 5.25″ FLOPPY DISK DRIVES

6106 Single-Headed 6108 Double-Headed

Specifications



SPECIFICATIONS: BASF 6106/6108 FLEXY DISK DRIVES

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SPECIFICATIONS: BASF 6106/6108 FLEXY DISK DRIVES

1 INTRODUCTION

1.1 General Description

The BASF 6106/6108 Flexy Disk Drive is a small, compact, high performance, low-cost flexible disk drive with dual head. The BASF 6108 is intended for calculators, desk-top computers, point of sale terminals, and word processing markets.

In most applications the BASF 6106/6108 is an excellent alternative to paper tape, magnetic tape cassettes and magnetic card devices and offers a more powerful, more reliable solution while still competitive in size and cost.

The BASF 6108 is downward-compatible to the BASF 6106 and has twice its capacity.

1.2 Specification Summary

1.2.1.1 Performance Specifications (6106)

Capacity (1 surface, unformatted)	
per disk	125,000 bytes (single density) 250,000 bytes (double density)
per track	3,125 bytes
Transfer-Rate	125 kilobits/sec
Latency (average)	100 msec
Positioning Time	
track to track	6 msec nominal, 9 msec max
average	160 msec
Head Settling Time (after track to track seek)	3 msec nominal
Head Load Time (with optional head load solenoid)	max. 35 msec
Drive Motor Start Time	max. 650 msec

1.2.1.2 Performance Specifications (6108)

Capacity (2 surfaces, unformatted)	
per Flexy Disk	250,000 bytes (single density) 500,000 bytes (double density
per Disk-Surface	125,000 bytes (single density) 250,000 bytes (souble density)
per Track	3.125 bytes
Transfer Rate	125 kilobits/sec
Latency (average)	100 msec
Positioning Time	
track to track	6 msec nominal, 9 msec max.
average	240 msec
Head Settling Time (after track-to-track seek)	3 msec nominal
Head Load Time (with optional head load solenoid)	max. 35 msec
Drive Motor Start Time	max. 650 msec

1.2.2 Functional Specifications

Rotational Speed	300 rpm $\pm$2.5%
Recording Density (inside track)	2768 bpi
Flux Density	5536 fci
Track Density	48 tpi
Tracks per Surface	40
Data Sectors	
softsectoring	9 or 16 sectors recommended
hardsectoring	10 or 16 sectors recommended
Index	1

Encoding Method	FM or MFM
Media Requirements	BASF Flexydisk 5.25-2 or equivalent (Double-density required for double-density operation.)

1.2.3 Physical Specifications

Environmental Limits

Ambient Temperature (Operation)	10°C to 50°C (50°F to 122°F)
Shipping Condition	-40°C to 62°C (-40°F to 143°F)
Storage Condition	-22°C to 55°C (-7.6°F to 131°F)
Relative Humidity	20% to 80%
Maximum Wet Bulb	29°C (84.2°F)

Power Requirements

+5V +5%, 50mVpp	Ripple, .5 A
+12V ±5%, 100 mVpp	Ripple, .7 A (with Doorlock)

12 V Power Distribution	Additional	Total
Standby	.10 A	.10 A
Stepper Motor On	.25 A	.35 A
Drive Motor On	.05 A	.40 A
Head Load (optional)	.20 A	.60 A
Doorlock (optional)	.10 A	.70 A
Total (including options)	.70 A	.70 A

Drive Motor start current does not exceed 1.4 A (typically 1.2 A for 50 ms).

Headload start current: .7 A for 50 ms

Mechanical Dimensions

Width	146.1 mm (5.75 in.)
Height	53.5 mm (2.11 in.)
Depth	196.5 mm (7.74 in.)
Weight	1.4 kg (3.09 lb.)

Power Dissipation

10 watts operating
4.0 watts stand by (Motor Off)
7.5 watts Motor-On and Deselect

1.2.4 Reliability Specifications

MTBF	10,000 POH under typical usage
Unit Life Time	5 years
MTTR	30 Minutes

Error Rates

Soft Read Errors	1 per 10^{9} bits read
Hard Read Errors	1 per 10^{12} bits read
Seek Errors:	1 per 10^{6} seeks

1.2.5 Media Specifications

BASF Flexydisk 5.25-2 or equivalent

Jacket	133.4 mm (5.25in.) square
Disk	130.2 mm (5.125 in.) diameter
Center Hole	28.575 mm (1.125 in.) diameter

1.2.6 Shock and Vibration

a. Operating -- The drive, normally installed and positioned, shall meet the full specified performance while subject to the following conditions injected in the three major mutually perpendicular axes.

Vibration: 1g acceleration 5-100 Hz

b. Shipping (as packed by factory) -- The drive shall withstand the conditions of vibration injected in the three major mutually perpendicular axes for:

Vibration: 2g acceleration 5-100 Hz

Free fall of 0.5 m (20 inches) as packed by the factory will not cause any damage to the drive.

2 FUNCTIONAL CHARACTERISTICS

2.1 General Operation

The BASF 6106/6108 Flexy Disk Drive consists of Read/Write and control electronics, drive mechanism, Read/Write heads, and a track positioning mechanism. These components perform the following functions:

Interpret and generate control signals.
Move Read/Write heads to the selected track.
Read and write data.
Rotate disk.

An interface signals block diagram for the internal functions of the BASF 6106/6108 is shown in Fig. 2.1.

The head positioning actuator positions the Read/Write heads to the desired track on the disk. The head load actuator loads the disk against the Read/Write heads, and data then may be recorded onto or read from the disk.

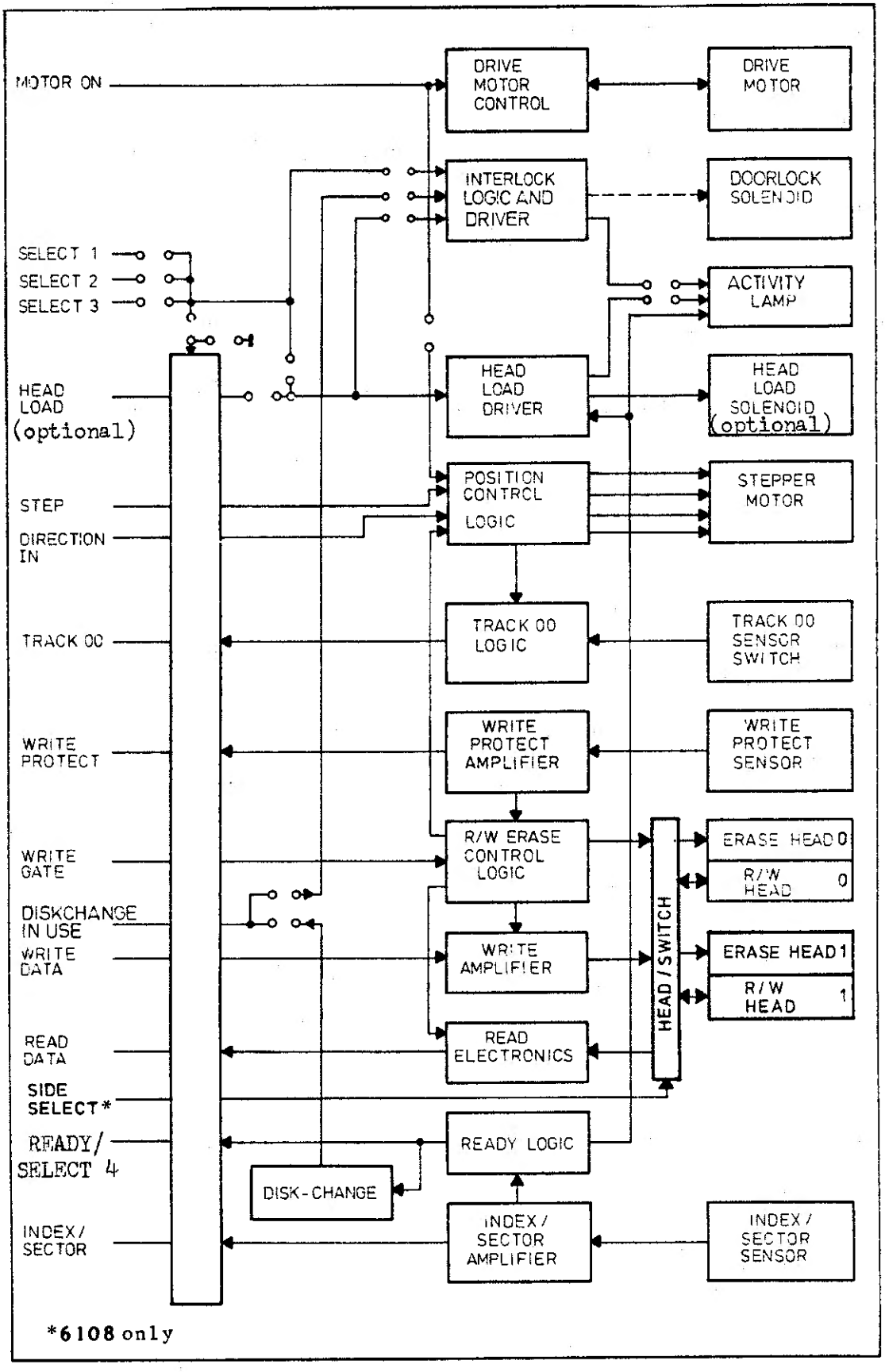
2.2 Read/Write and Control Electronics

The electronics are packed on one PCB, located on the upper side of the drive. The logic PCB contains:

- Select Logic
- Index/Sector Detector Circuit
- Positioning Control Logic
- Head Load Driver (optional)
- Write Protect Logic
- Track 00 Logic
- Drive Motor Control
- Ready Logic
- Software Interlock Logic
- Read Chain with Comparator
- Write Chain

Connection to the host system is via two connectors on the logic PCB.

Figure 2.1 -- Block Diagram BASF 6106/6108



2.3 Drive Mechanism

The DC drive motor rotates the spindle at 300 rpm ±2.5% through a belt-driven system. A centering cone that moves in conjunction with the front door fixes the flexy-disk to the spindle.

2.4 Positioning Mechanism

The carriage will be positioned by moving an attached ball-bearing over a spiral disk. The stepping motor rotates the spiral disk clockwise or counterclockwise in increments. Each step pulse on the interface causes the heads to be positioned to an adjacent track position.

2.5 Read/Write Heads

The BASF 6106/6108 has single gap ceramic Read/Write heads with tunnel erase elements to provide erased areas between data tracks. Thus, normal interchange tolerances between media and drives will not degrade the signal to noise ratio and insure flexy-disk interchangeability.

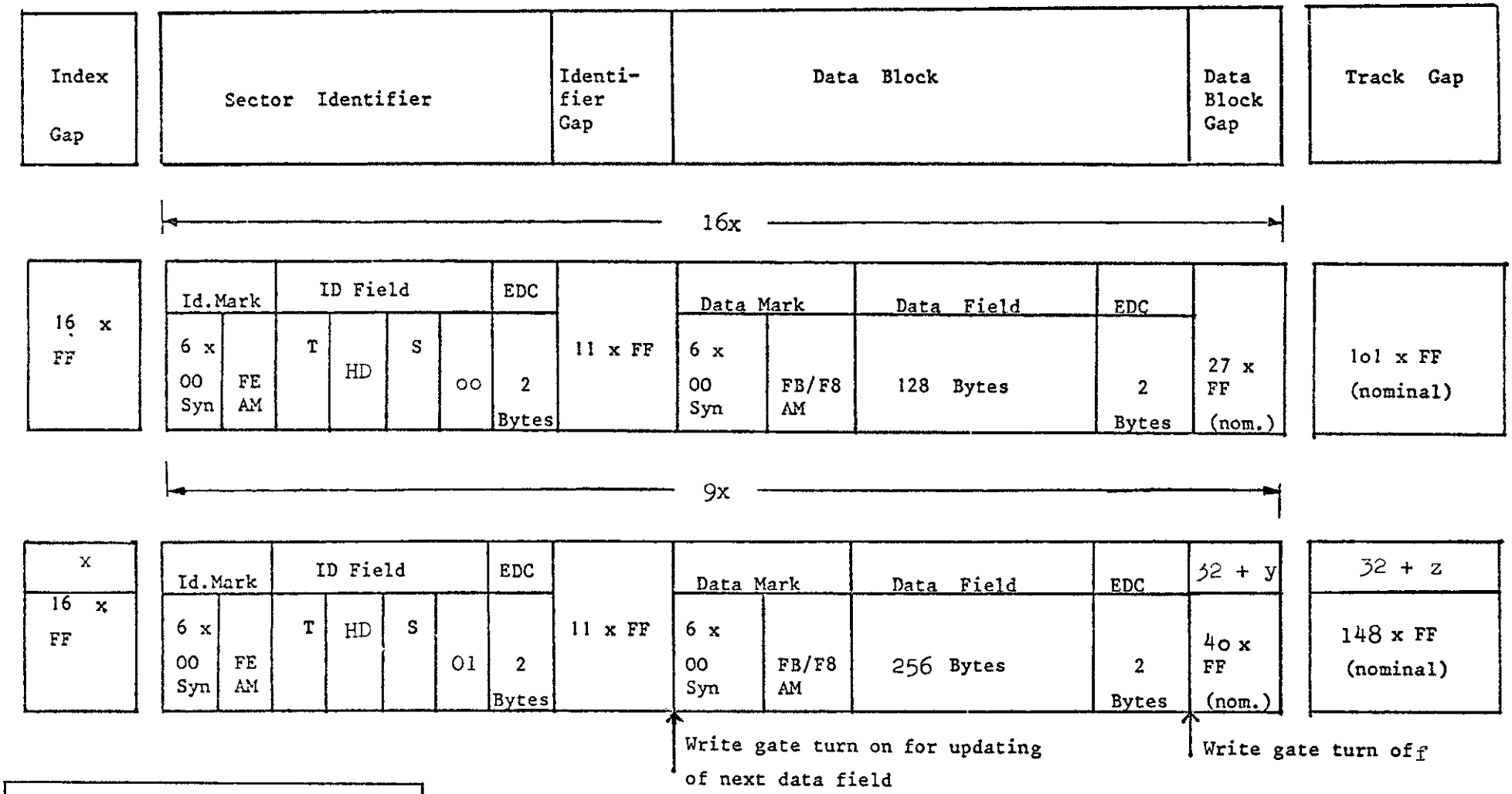
The Read/Write heads are mounted on a carriage which moves on rails controlled by the spiral wheel. The Flexy-Disk is held in a fixed position to the Read/Write heads by two guide ways. These guide ways, together with a reference plate on the casting, assure accurate compliance with the Read/Write heads. The Flexy-Disk is loaded against the button type head with the catamaran type head in the 6108 (Head Load Pressure Pad in the 6106), which is released by the manual door linkage or optional head load solenoid. Now data transfer can be accomplished. Both heads are in direct contact with the Flexy-Disk simultaneously.

Head surfaces have been designed for maximum signal transfer to and from the magnetic surface with minimum wear.

2.6 Door-Interlock

A signal from the host system activates a solenoid and locks the front door. The front door cannot be opened and this prevents accidental removal of the Flexy-Disk. Depending on jumper conditions, the door-lock can be controlled by various interface signals:

In Use
Select
Head Load



$$x + \sum(y_1 + \ldots + y_9) + z = 2048$$

T = Trackaddress (00 - 27) hex. (= 0 - 39 dec.) 1 Byte
S = Sectoraddress (01 - 10) hex. (= 1 - 16 dec.) 1 Byte
A = FB Data valid
AM = F8 Data deleted
EDC = Error detection code (2Bytes)
HD = Headaddress (00-01) 1 Byte

Figure 2.6 -- Recommended RECORDING FORMAT 16 Sectors and 9 Sectors (SOFT)

2.7 Activity-LED

An activity LED behind a lens in the front door may be used to indicate to the user certain operating conditions of the drive. It can be activated by one or a combination of the following interface signals, depending on the jumper connections:

In Use, Select, Head Load, in connection with the internal Ready Signal.

2.8 Recording Format

6106/6108's can be used with hard- or soft-sectors. The data organization on the disk is totally a function of the host system and can be designed as necessary for the user's application.

Recommended soft sectoring is either 16 sectors with 128 Bytes or 9 sectors with 256 Bytes. Formats for both are shown in Fig. 2.6.

2.8.1 Track Format 9 x 256 Bytes, Soft-Sectored

Index Gap

This gap is normally 16 Bytes of FF in length and the length is not affected by a possible overwriting process.

Identifier Gap

11 Bytes of FF between the ID field and the data field. This gap may vary slightly in length and become ill-defined after data field has been updated.

Data Block Gap

The 40 Bytes of FF between the data field and the next ID Mark is defined as data block gap. The data gap may vary slightly in length and may become ill-defined when the data field has been updated.

Track Gap

The 148 Bytes of FF between the last data block gap on a track and the Index Gap is defined as Track Gap. Initially this gap consists of nominally 148 Bytes. However, due to write frequency tolerances and the disk speed tolerances this gap may vary slightly in length.

Address Marks (AM)

Address Marks are unique bit patterns one byte in length which are used in this recommended recording format to identify the beginning of ID and data fields and to synchronize the deserializing circuitry with the first byte of each field. AM bytes, unique from other data bytes, do not contain all clock bits (3 missing). There are three types of AM's used, each identifying different types of fields.

Type I: ID-Address-Mark

Written Data Bits = FE (hex)
Written Clock Bits = C7 (hex)

Type II: Data Address Mark

Written Data Bits = FB (hex)
Written Clock Bits = C7 (hex)

Type III: Deleted Data Address Mark

Written Data Bits = F8 (hex)
Written Clock Bits = C7 (hex)

Sync Field

The Sync Field is used to synchronize the phase lock loop circuit.

EDC Gap (CRC)

To each field written on the diskette, 2 EDC bytes are added. These 2 EDC bytes are hardware generated by shifting serially the relevant bits through a 16-bit shift register described by the generator polynomial:

$$x^{16} + x^{12} = x^5 + 1$$

2.8.2 Read/Write Errors

To inhibit degradation from imperfections in the media, do not make more than 4 attempts to write a record when read after write errors are encountered. If a record cannot be successfully written within 4 attempts, label the sector or track "defective" and assign an alternate. If more than 2 defective tracks are encountered, replace the disk.

In the event of a read error, up to 10 attempts should be made to recover with rereads. If the data still has not been recovered, unload and load the heads, then step the heads several tracks away and reposition to recover the data. If the error persists, repeat the sequence at least 10 times.

The recoverable read error rate is one in 10^9 bits. The unrecoverable read error rate is one in 10^{12} bits.

2.8.3 Seek Errors

Seek errors rarely occur unless the stepping rate is exceeded. In the event of a seek error, recalibration of track location can be achieved by repetitive Step-Out commands until a Track 00 signal is received. The access mechanism positioning error rate shall be less than one position error per 10^6 seek operations.

2.9 Power Sequencing

Power-up and Power-down can be done in any sequence. An internal DC-control-logic will prevent any erroneous writing during power-up or down. At the interface, Write-Gate must be kept high during power sequencing.

3 ELECTRICAL INTERFACE

The interface of the BASF 6106/6108 can be divided into two basic parts:

1. Signal
2. Power

The following figures provide the electrical definition for each line:

Fig. 3.0 — Interface Connections
Fig. 3.2 -- Timing

3.1 Signal Interface

The signal interface is either daisy-chained or radial. Up to 3 BASF 6106/1608's can be connected. (4 can be connected without Ready signal.) In radial connections all drives are terminated. In daisy-chained connections only the last drive is terminated.

WARNING -- The last drive, and ONLY the last drive must be terminated.

The resistor chip on the logic PCB close to the connector J1 is provided for termination. This chip can be removed.

Without the resistor chip no termination except for the select line is provided.

Signals consist of two categories:

1. Control Status
2. Data Transfer

All lines in the signal interface either provide signals to the drive (input) or provide signals to the host (output) via interface connector P1/J1.

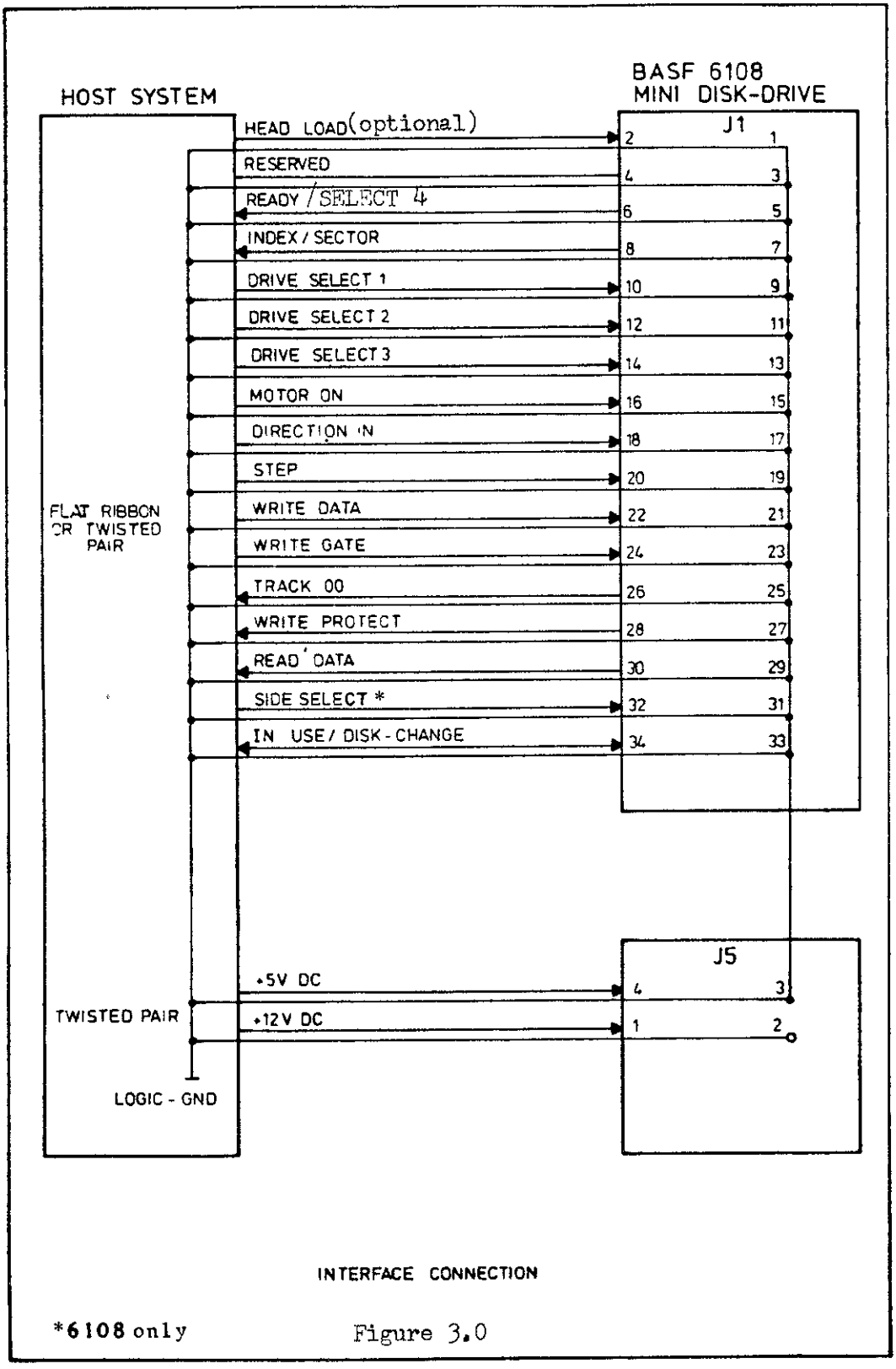
The Pin assignments for Interface Connector P1 are:

Ground Return Pin	Signal Pin	Signal
1	2	Headload (optional)
3	4	Reserved
5	6	Ready/Select 4
7	8	Index
9	10	Select 1
11	12	Select 2
13	14	Select 3
15	16	Motor On
17	18	Direction In
19	20	Step
21	22	Write Data
23	24	Write Gate
25	26	Track 00
27	28	Write Protect
29	30	Read Data
31	32	Side-Select*
33	34	In Use/Disk Change

*6108 only

The pin assignments for the DC power connector P5 are:

Pin	Name
1	+12 V DC
2	+12 V Ground
3	+5 V Ground
4	+5 V DC



INTERFACE CONNECTION

*6108 only

Figure 3.0

3.1.1 Input Lines

There are 10 signal input lines in the basic unit interface. The recommended circuit is:

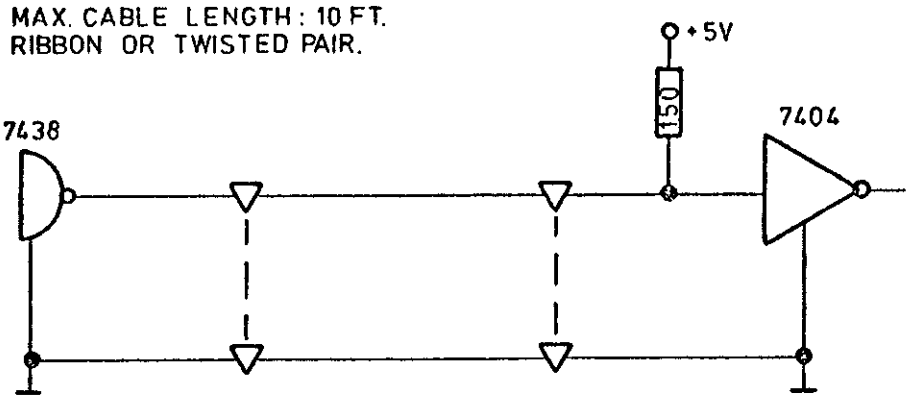


Figure 3.1.1 -- Control Signal Driver/Receiver

The specification for the signal interface is:

Logical Zero = .0 V to .8 V (Active State)
Locigal One = +2.0 V to 5.25 V (Inactive State)

3.1.1.1 Select 1-4

Drive selection activates a particular drive on the daisy-chain interface. Only the activated drive will respond to the input lines and gate the output lines.

Four separate input lines, Select 1, Select 2, Select 3, and Select 4 are provided so that up to four drives may be daisy-chained in a system. (Select 4 is standard on drives using LSI control PCB; instructions for modification of other drives are available from BASF.

A jumper on the logic PCB (close to the connector J1) defines whether Select 1, 2, 3, or 4 is connected. Standard drives from production are jumpered to Select 1 if not otherwise ordered.

Drives equipped with Head Load solenoid option are normally jumpered so that Motor On signal loads the head (when disk is in place and door is closed). The jumpers can be changed so that the Select signal independently loads and unloads head(s).

By changing a jumper, the Head Load function (on drives equipped with solenoid Head Load option) can be made independently from Select. In this case the loading and unloading is a function of the status of the signal line Head Load.

In systems with a single drive a special select mode can be chosen by changing a jumper so that the drive is always selected. The select line may then be used for head loading.

See Jumper Options, Fig. 3.1.3.

3.1.1.2 Motor On

This input, when activated to a logical zero level, will load the Read/Write head(s) and turn on the drive and stepper motors. Reading or writing are not permitted before the Ready Line becomes active. For hard sectoring an additional delay of 500 ms is required before Ready is valid. In addition a recalibration function (positioning onto Track 00) must be performed to obtain correct head positioning.

Control of the stepper motor by Motor On may be disabled by removing a jumper, thus avoiding recalibrtating after switching on the motor. The Motor-On line is not gated with select. The motor will not be switched off when the drive is deselected.

3.1.1.3 Direction In

This interface line is a control signal which defines the direction of motion the Read/Write head will take when the step line is pulsed. An open circuit or logical one defines the direction as "out"; and, if a pulse is applied to the Step line, the Read/Write head will move away from the center of the disk. Conversely, if this input is connected to ground or to logical zero level, the direction of motion is defined as "in"; and, if a pulse is applied to the Step line, the Read/Write head will move toward the center of the disk.

3.1.1.4 Step

This interface line is a control signal which causes the Read/Write heads to move with the direction of motion as defined by the Direction-In line. This signal must be a logical zero-going pulse. The nominal step rate is 12 msec. The access motion is initiated on each logical zero to logical one transition, or the trailing edge of the signal pulse. Any change in the Direction-In line must be made at least 1 µs before the trailing edge of the Step pulse. Stepping will be inhibited if the write gate signal is at logical zero level.

3.1.1.5 Write Gate

The active state of this signal, or logical zero, enables Write-Data to be written on the disk. If the disk is write protected, the writing is internally inhibited. The inactive state, or logical one, enables the read-data logic (Read Data). Write Gate will activate internal erase, and erase will stay enabled up to 1200 µs after Write Gate was turned off.

3.1.1.6 Write Data

This interface line provides the data that is to be written on the disk. Each transition from a logical one to logical zero will cause the current through the Read/Write heads to be reversed, thereby generating a flux change. This line is enabled within the drive by Write Gate being active. No pulses should be on the Write Data line when the drive is reading.

3.1.1.7 In Use

This signal will control the door-lock solenoid and the activity LED. Depending on the jumper connections, two modes of operation are possible:

a. As long as this line is kept continuously at a zero level, the door-lock solenoid is activated and the Flexy Disk cannot be removed.

b. A zero level on this line will be set with Select into a latch and this latch activates the door-lock. A high level will, in conjunction with Select, reset the latch and release the door-lock.

Installation of the In Use option disables the Disk-Change option.

3.1.1.8 Head Load (with optional solenoid)

With appropriate jumpering, a logical zero on this line loads the heads. A transition back to logical one unloads the heads. This allows the loading and unloading of the heads separately from the selection. Depending on jumper settings, the heads can be loaded with Head-Load, Head-Load and Select, Select only, or Motor On. The heads are loaded only when the drive is Ready and will unload when the Ready signal disappears.

3.1.1.9 Side-Select (6108 only)

The Side Select signal selects the Read/Write head used. A logical one will select head one; a logical zero will select head two.

When switching from one side to the other a 200 µs delay is required when reading and 1200 µs when writing. (On a 6106, this line must be held at logic one level at all times.)

3.1.2 Output Lines

There are five output control lines. Please see Fig. 3.1.1 for the recommended circuit.

Logical zero = 0.0 V to +0.8 V
Logical one = +2.0 V to +5.25 V

3.1.2.1 Ready

The Ready lines will be at a logical zero when power is ON, a disk has been inserted and it is rotating correctly. A logical one indicates that either no disk has been inserted, it is not rotating or there is a failure within the drive (i.e., no Index).

3.1.2.2 Track 00

This signal is a logical zero when the drive Read/Write head is physically positioned at Track 00 (the outermost track) and the motor control circuitry is driving current through phase A and C of the stepper motor. Being at Track 00 and issuing a step out, the Track 00 signal will go to a logical one, even though a mechanical stop keeps the head over Track 00. Because the 4-phase stepper is in a wrong phase, there are three more steps out necessary to put the stepper back in the proper phase (phase A and C) and to get the Track 00 signal logical zero.

This signal is at logical one when the selected drive's Read/Write head is not on Track 00.

3.1.2.3 Index

This interface signal is provided by the drive for each sector or index hole which appears under the sector/index photo detection transducer. Normally this signal is logical one and makes the transition to the logical zero level for a period of approximately 2 ms for each hole. One hole indicates the beginning of a track for a soft sectored disk.

To indicate the beginning of the track with hardsectoring, once per revolution there is one index transition centered between sixteen equally spaced sector transitions. The timing of this signal is shown in Fig. 3.1.2.2. The index signal remains logical zero if no disk is inserted.

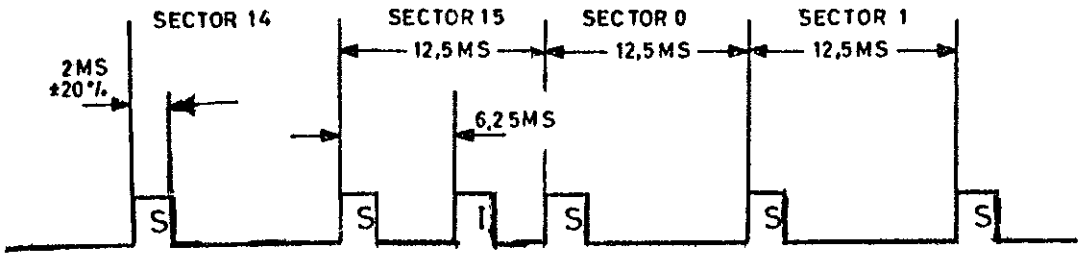


Figure 3.1.2.2 Index/Sector Timing (Hard Sectored Disk)

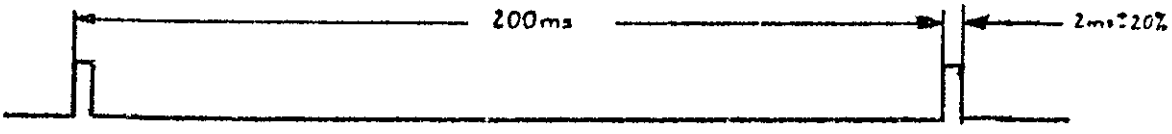


Figure 3.1.2.3 Index Timing (Soft Sectored Disk)

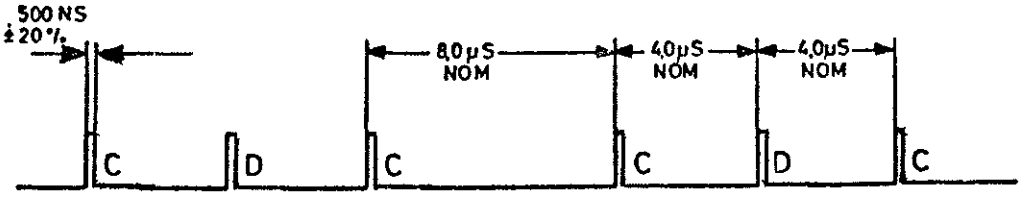


Figure 3.1.2.4 Read Data

3.1.2.4 Read Data

This interface line provides the "raw data" (clock and data together) as detected by the drive's read electronics. Normally, this signal is logical one and becomes logical zero for every flux transition detected on medium. Figure 3.1.2.4 represents bit timing for FM.

3.1.2.5 Write Protect

This interface signal is provided by the drive to give the user an indication when a write-protected Flexy Disk is installed. This signal is at logical zero when the Flexy Disk is protected. With a protected diskette installed the drive will inhibit writing.

The write protect notch in the jacket must be covered (ANSI) by a non-transparent lable to protect the Flexy Disk against writing. By changing jumpers on the PC board, an open notch (ECMA) can be defined as write protected.

3.1.2.6 Disk Change

Whenever the Flexy Disk is removed from the drive a disk change flip-flop is set. This flip-flop is reset by deselecting the drive. The status of this flip-flop is given with Select on the Diskchange line. If the line is at logical zero, the disk has been removed. The line will stay at zero as long as no other disk is inserted. The installation of Disk Change disables the In Use function.

3.1.3 Jumper Options

As previously described, certain functions can be alternated in their performance by setting jumpers on the PC board differently. Fig. 3.1.3 is a block diagram in true logic to illustrate how Head Load, Activity LED, Write Protect and the Stepper Motor can be controlled by Jumpers JJ1 through JJ4.

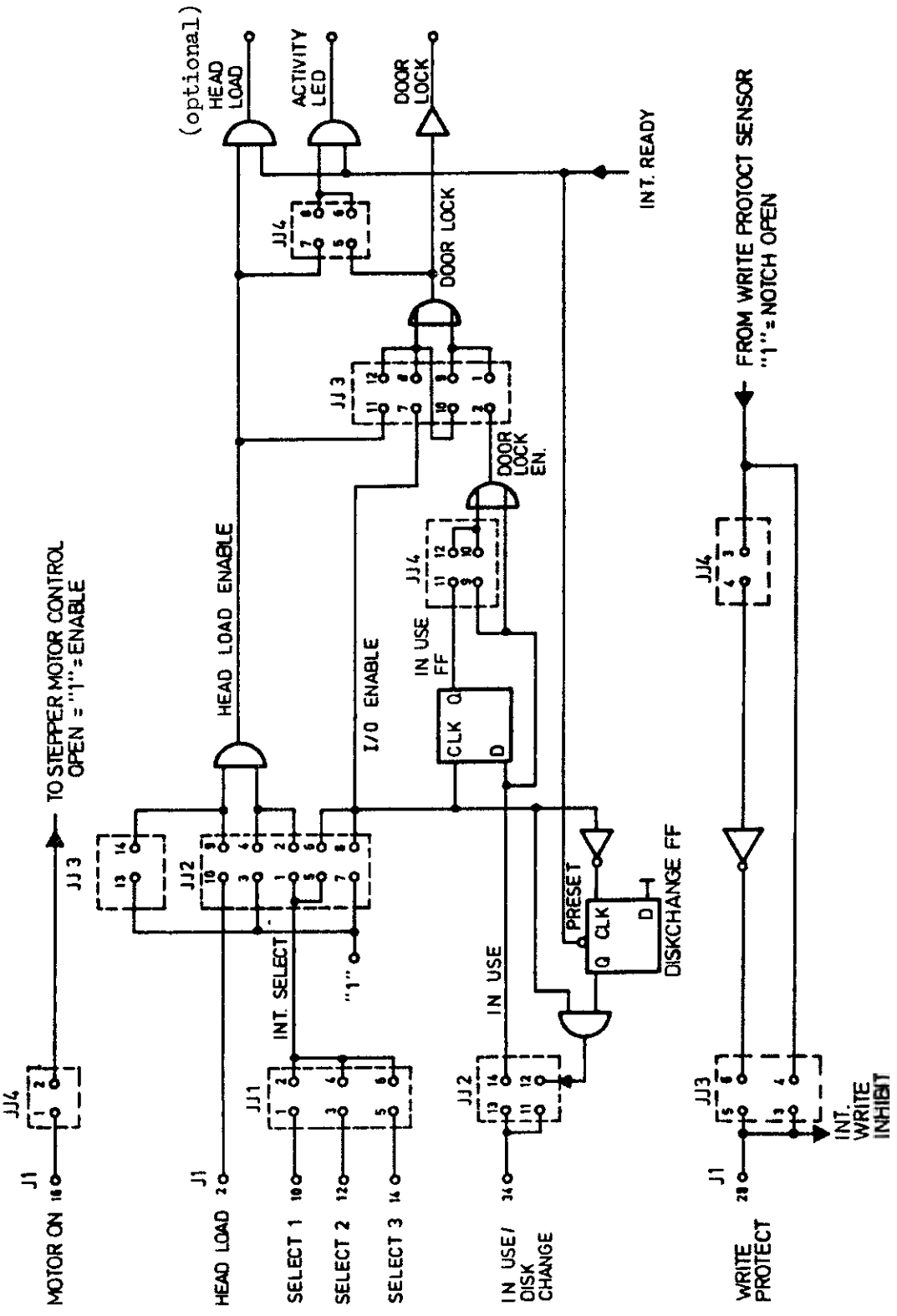
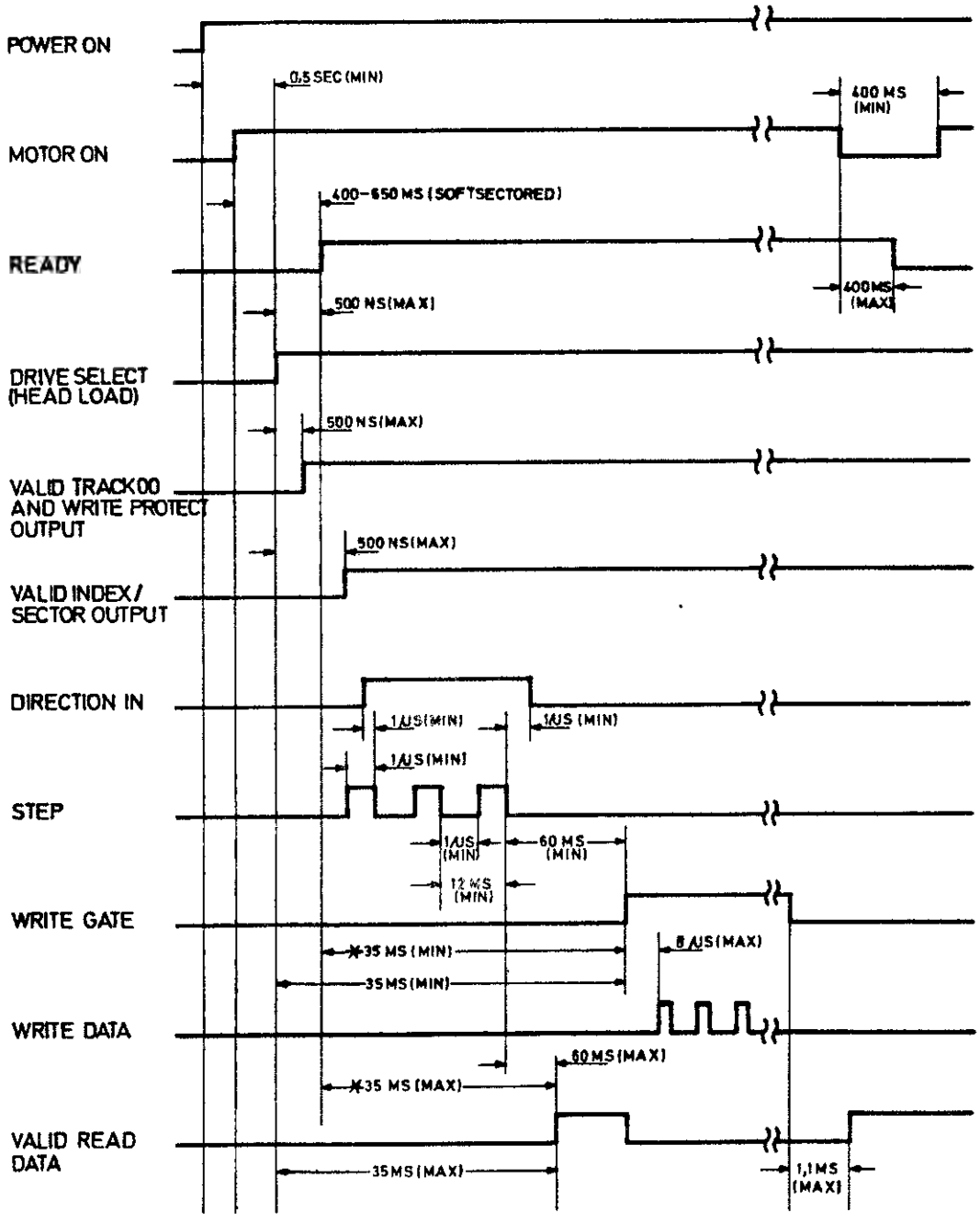


Figure 3.1.3 -- Block Diagram: Jumper Options

GENERAL CONTROL/TIMING REQUIREMENTS



NOTE: ABOVE TIMING IS SHOWN AS POSITIVE LOGIC. SIGNAL LINES AT INTERFACE ARE NEGATIVE LOGIC.

* 535 MS, WHEN USING HARD SECTORED DISKS.

4 PHYSICAL INTERFACE

The electrical interface between the host system and the BASF 6106/6108 is via 2 connectors. The first, J1, provides the signal interface; and the second, J5, provides the DC power interface. A plug kit containing all mating connectors is available under BASF P/N 80641-102.

4.1 Signal Connector (J1)

J1 is a 34 pin PCB edge card type connector whose dimensions are shown in Fig. 4.1. The pins are numbered 1 to 34 with the even pins on the component side of the board. Each signal requires a "Pin/Pair," with the signal always going to an even numbered pin and its ground return going to the odd numbered pins (on the other side of the connector).

Pin 2 is located on the end of the PCB connector closest to the Stepper Motor and is labelled. A key slot is provided between pins 4 and 6. The recommended mating connector is Scotch-flex ribbon connector P/N 3463-0000 or P/N 3463-0001 and Key 3M3439 or Amp. printed circuit connector P/N 583717-5 utilizing Amp contacts P/N 1-583616-1. (See Fig. 4.1.)

4.2 Power Connector (J5)

DC power connector is a 4 pin connector mounted on the component side of the PDB. (See Fig. 4.2.) The recommended mating connector (P5) is Amp. P/N 1-480424-0 utilizing Amp pins P/N 60619-1.

4.3 Frame Connector

To insure proper operation, the BASF 6106/6108 must be frame-grounded. If the drive is not fastened directly to the frame of the host system, grounding can be accomplished by connecting a solid wire with a connector (Amp. P/N 609721-1) to the provided ground tab.

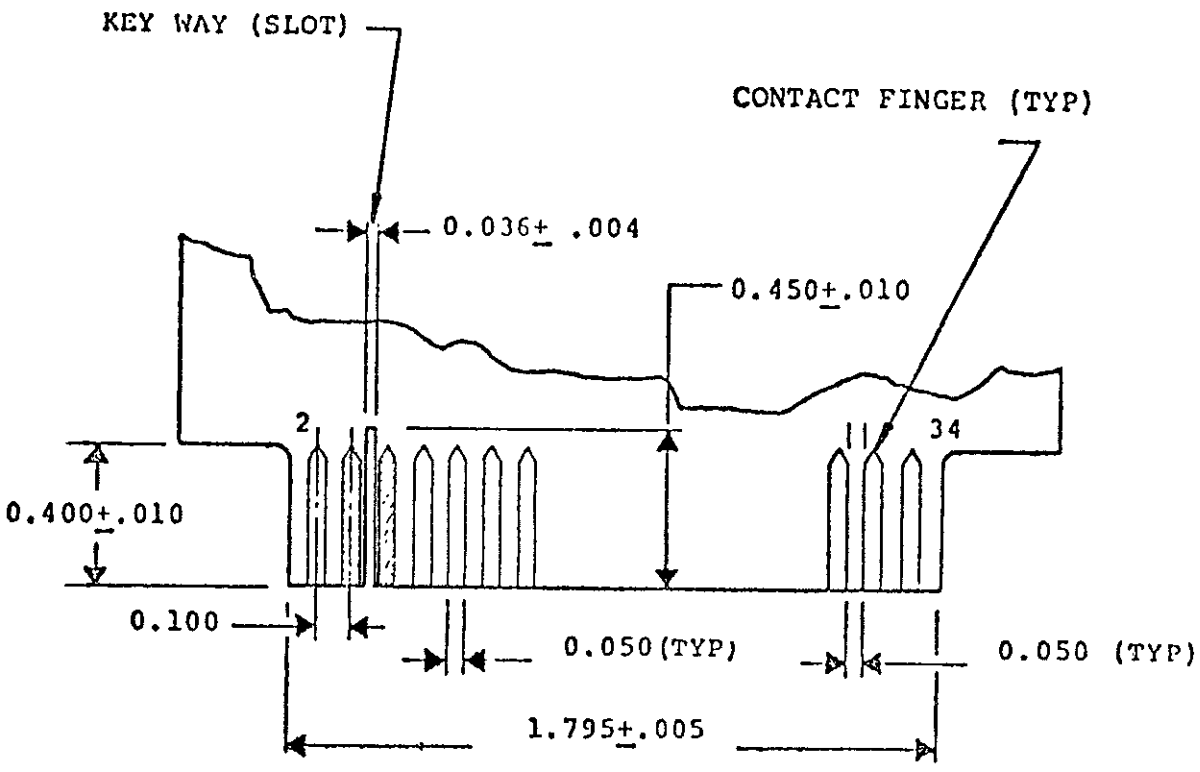
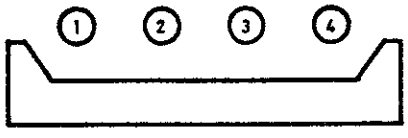


Figure 4.1 -- Signal Connector (J1)



POWER CONNECTOR (J5)

POWER CONNECTOR NO. 1 --- +12 VDC
2 --- +12 V RETURN (GROUND)
3 --- + 5 V RETURN (GROUND)
4 --- + 5 VDC

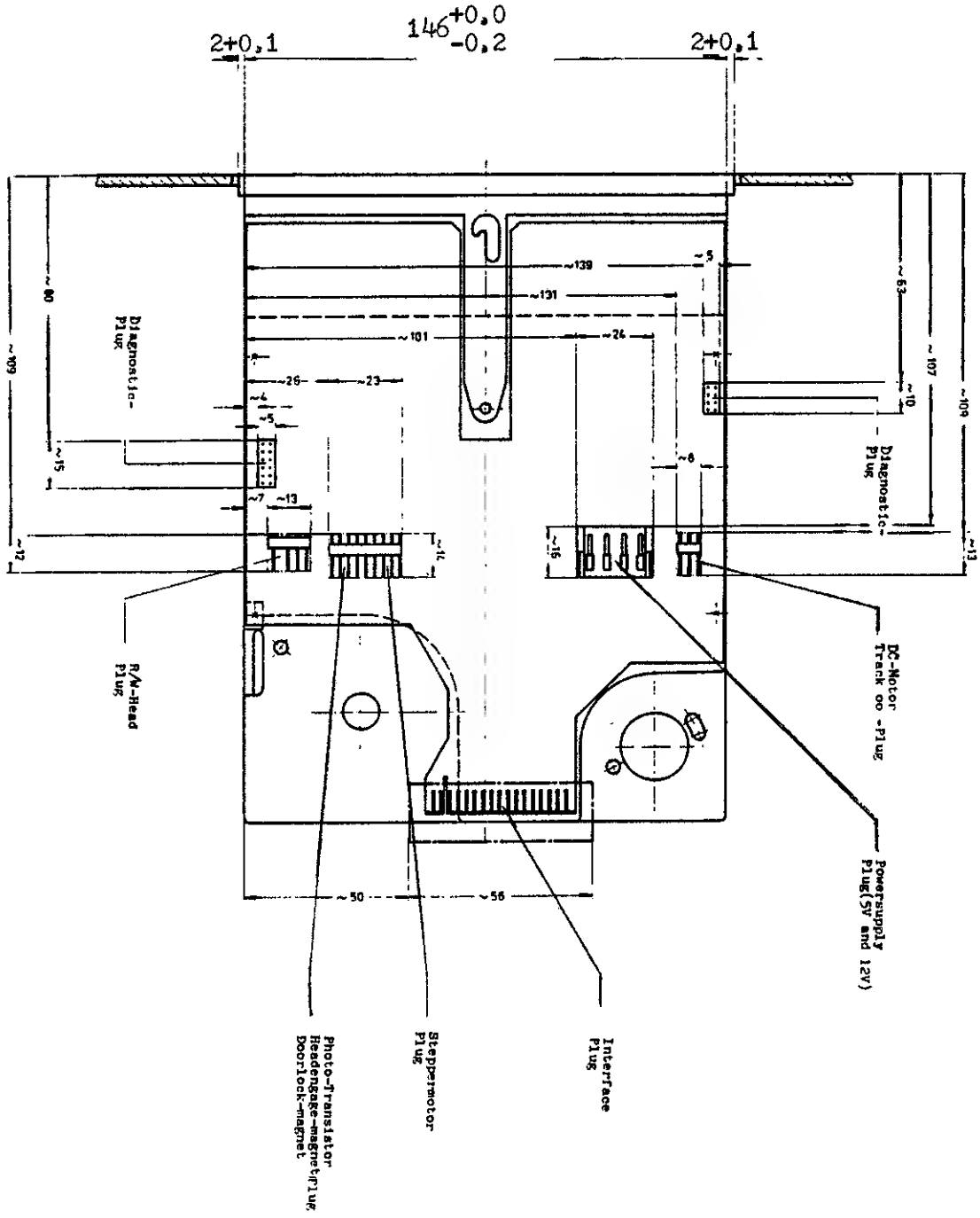
Figure 4.2 -- Power Connector (J5)

5. DRIVE PHYSICAL SPECIFICATIONS

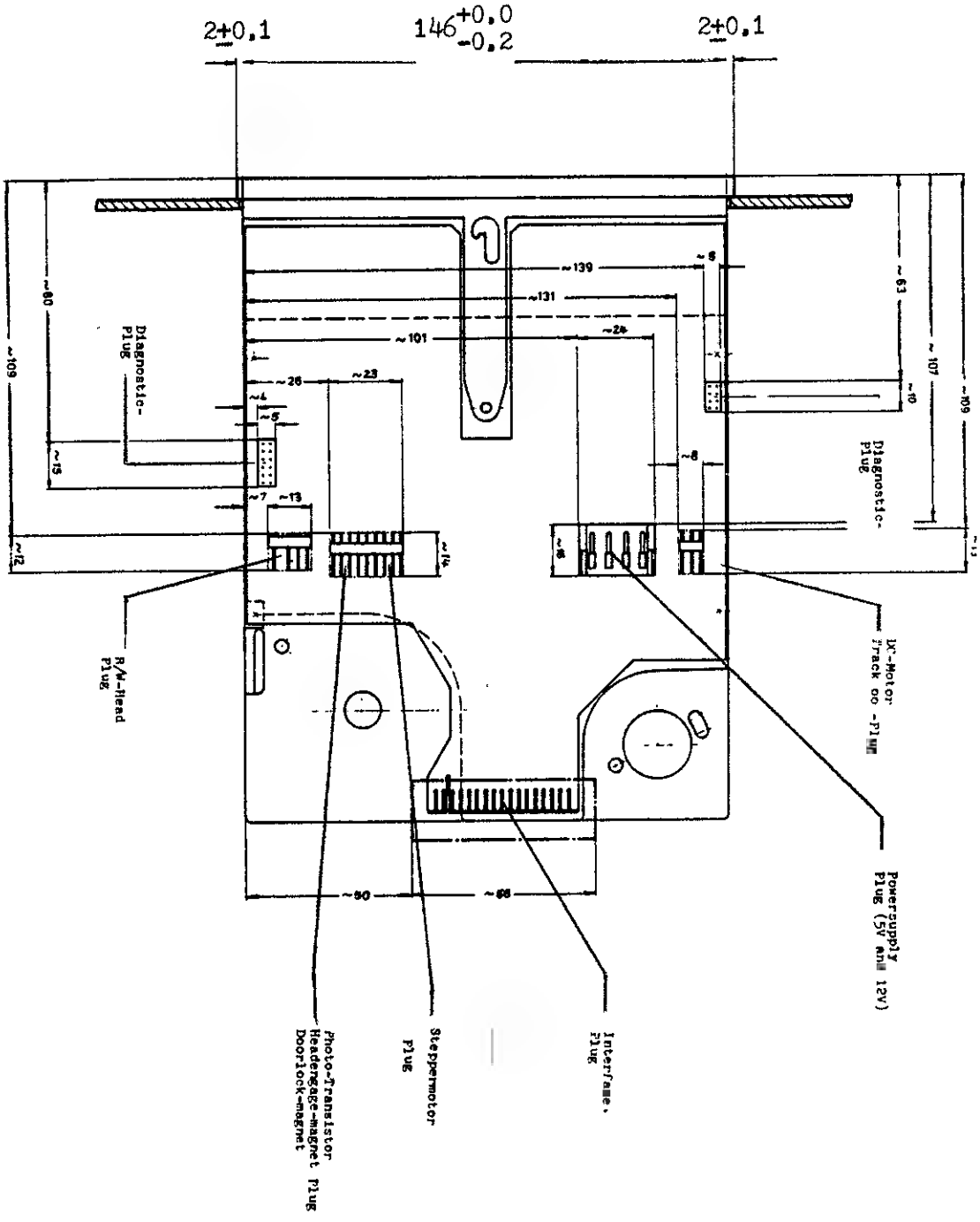
This section describes the mechanical dimensions and mounting recommendations for the BASF 6106/6108.

The BASF 6106/6108 is also available with an industry-standard front panel, as well as with a front panel which is identical in both appearance and function with other popular drives.

The BASF 6106/6108 may be mounted in any position.

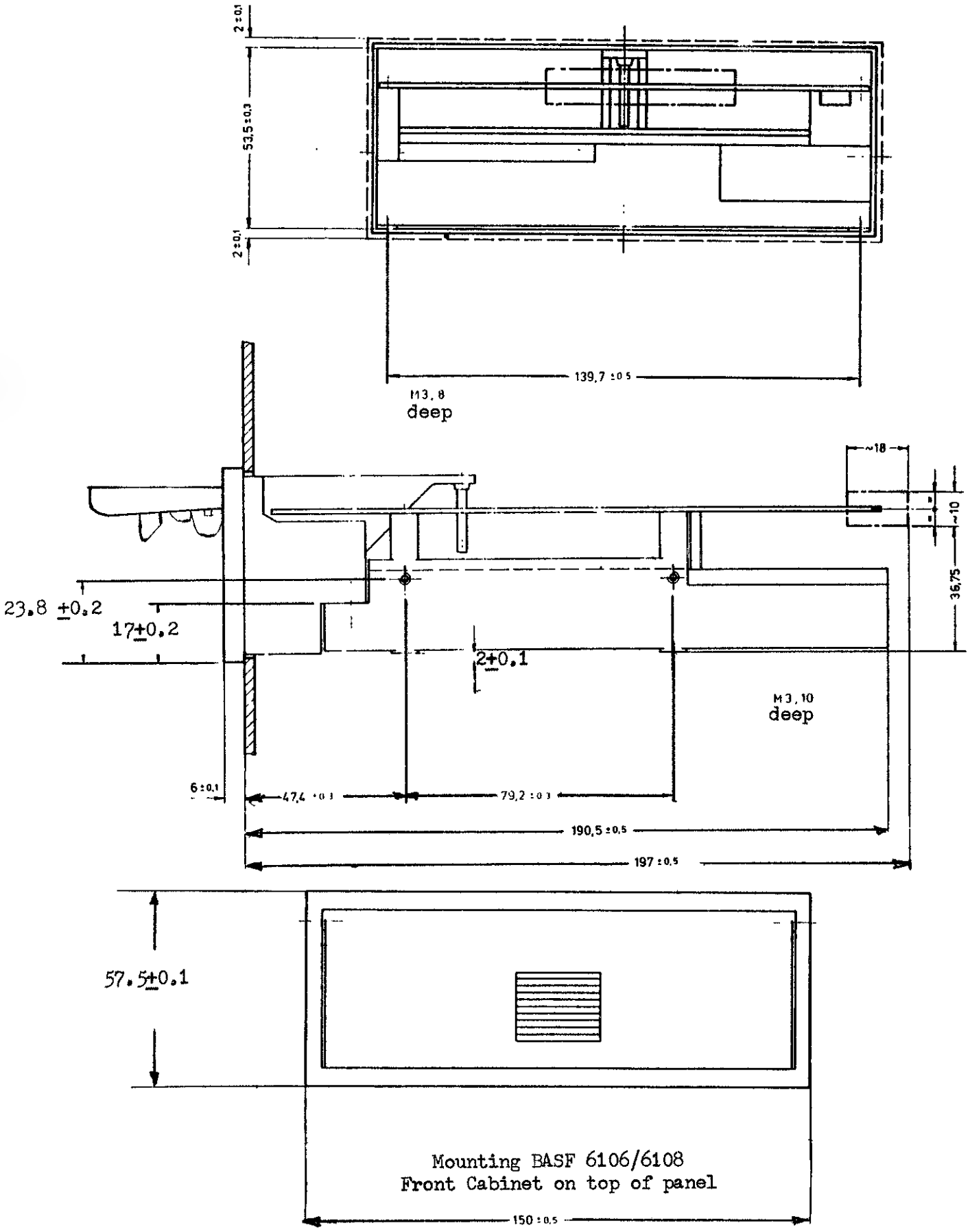


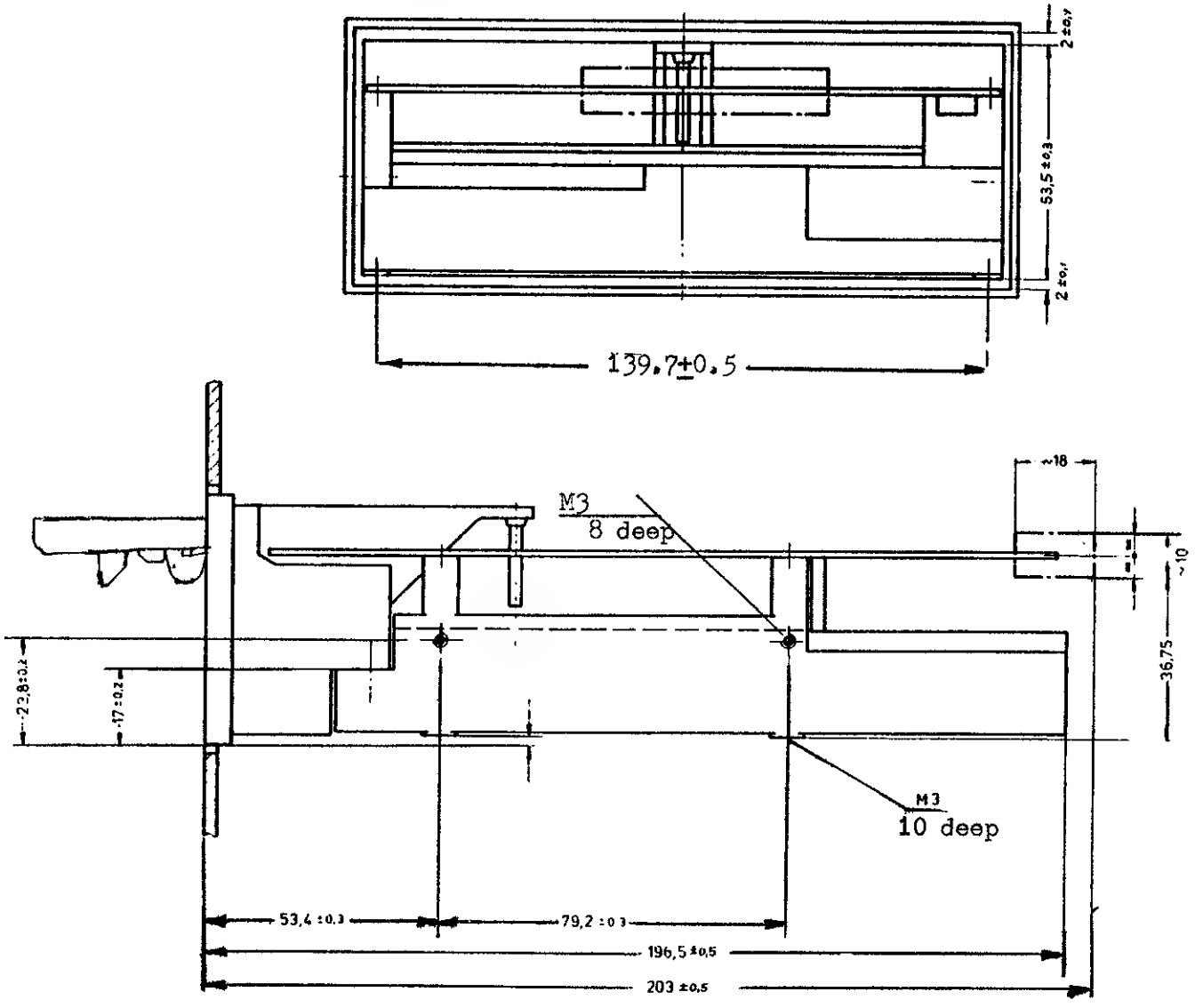
Mounting BASF 6106/6108, Top View
Front Cabinet in line with panel

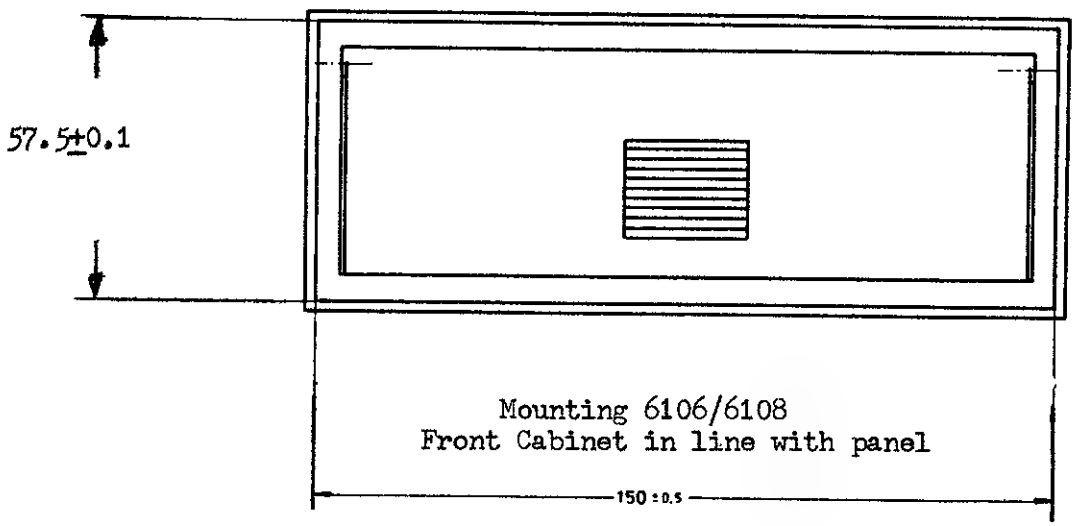


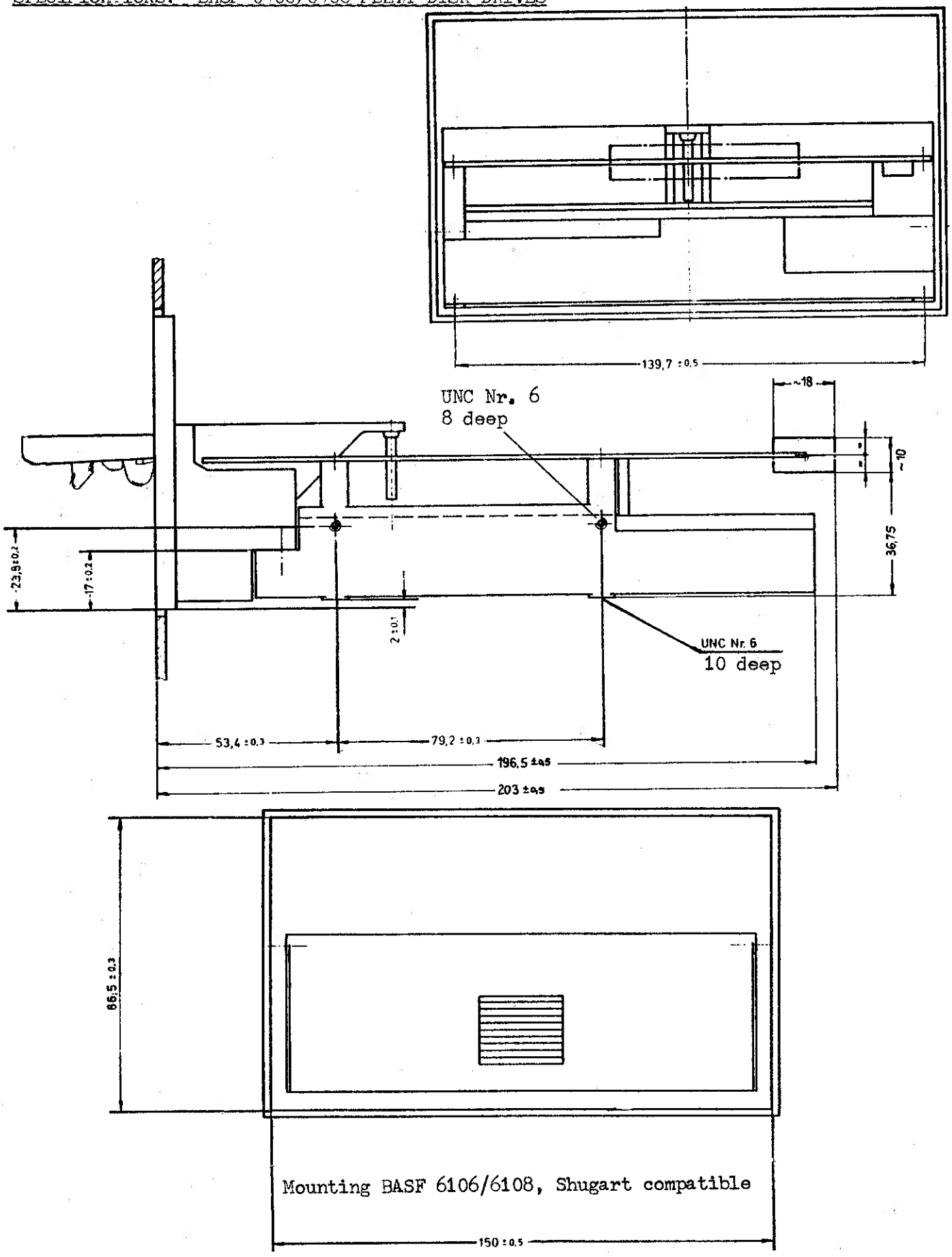
Mounting BASF 6106/6108, Top View
Front Cabinet on top of panel

SPECIFICATIONS: BASF 6106/6108 FLEXY DISK DRIVES

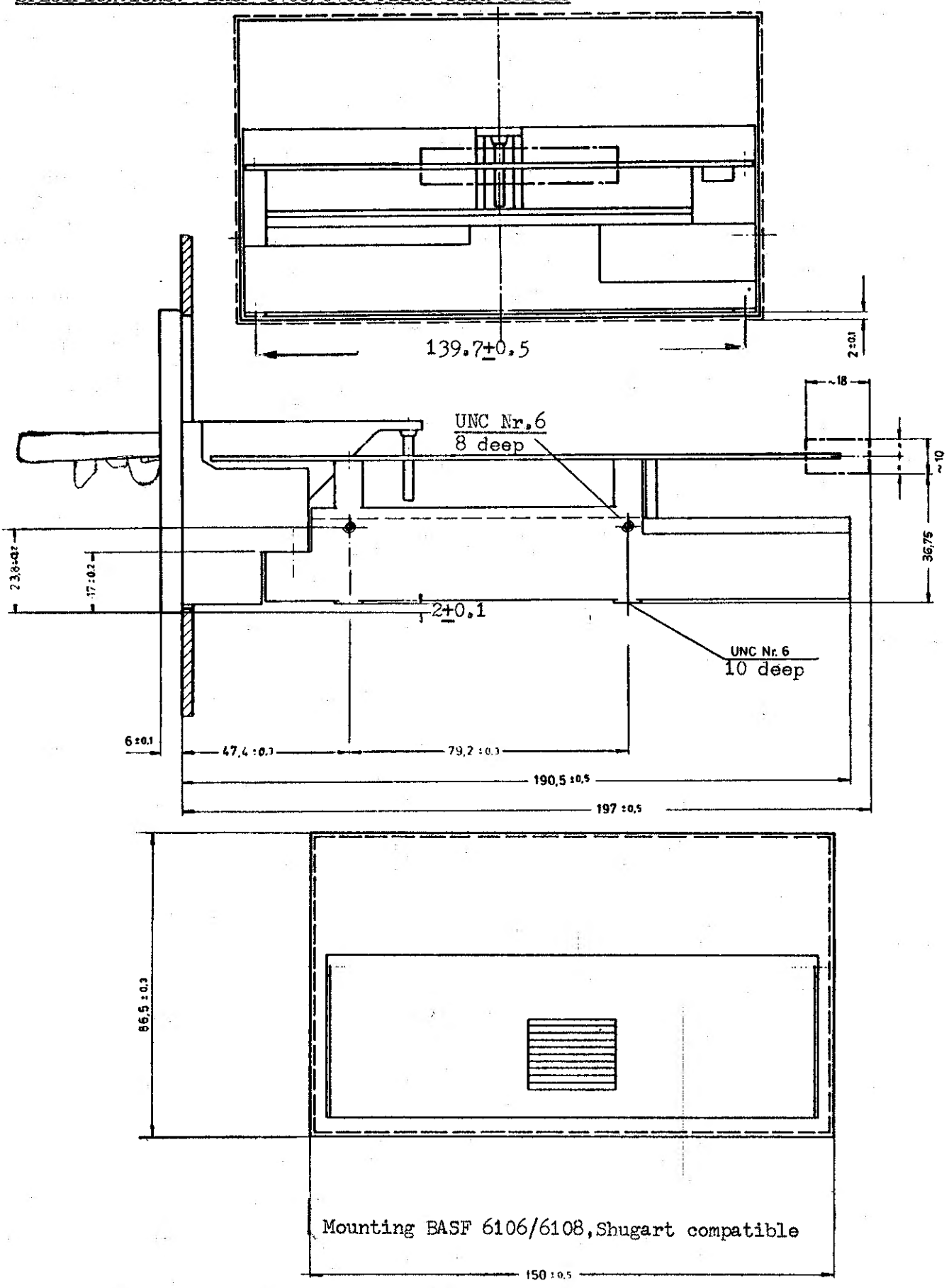



2 ±0,1
53,5 ±0,3
2 ±0,1
139,7±0,5
M3
8 deep
~18
~10
36,75
23,8±0,2
17±0,2
M3
10 deep
53,4 ±0,3
79,2 ±0,3
196,5 ±0,5
203 ±0,5


57.5±0.1
Mounting 6106/6108
Front Cabinet in line with panel
150 ±0,5


139,7 ±0.5
UNC Nr. 6
8 deep
~18
~10
36,75
23,8±0.2
17±0.2
2±0.1
UNC Nr. 6
10 deep
53,4 ±0.3
79,2 ±0.3
196,5 ±0.5
203 ±0.5
86,5 ±0.3
Mounting BASF 6106/6108, Shugart compatible
150 ±0.5

SPECIFICATIONS: BASF 6106/6108 FLEXY DISK DRIVES



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